



Test Report: HRP-600N-12

600W Single Output with PFC Function

■ DESIGN VERIFY TEST

Output Function Test

Input Function Test

Protection Function Test

Control Function Test

Component Stress Test

■ SAFETY & E.M.C. TEST

Safety Test

E.M.C. Test

■ RELIABILITY TEST

ENVIRONMENT TEST

DESIGN VERIFY TEST

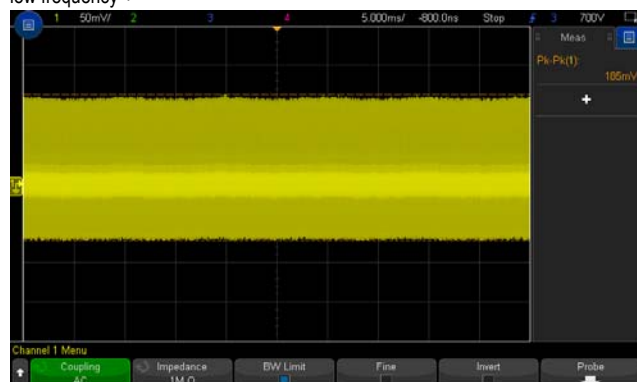
OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OUTPUT VOLTAGE ADJUST RANGE	CH1: 10.2 V~ 13.8 V	I/P : 230 VAC I/P : 115 VAC O/P : MIN LOAD Ta : 25°C	9.77V~14.28V/230VAC 9.75V~14.28V/115VAC
2	OUTPUT VOLTAGE(Max) TOLERANCE	V1: -1.0 %~ +1.0 %	I/P: 85VAC /264VAC O/P:FULL/ MIN. LOAD Ta:25°C	V1: -0.10%~ 0.14%
3	LINE REGULATION (Max)	V1: -0.3 %~ +0.3 %	I/P: 85VAC~ 264VAC O/P:FULL LOAD Ta:25°C	V1: -0.02%~ 0.06%
4	LOAD REGULATION(Max)	V1: -0.5 %~ +0.5 %	I/P: 230VAC O/P:FULL ~MIN LOAD Ta:25°C	V1: -0.10%~ 0.14%
5	OVER/UNDERSHOOT TEST	< ±5%	I/P: 230VAC O/P:FULL LOAD Ta:25°C	1.67%
6	RIPPLE & NOISE(Max)	V1: 200mVp-p	I/P:230VAC O/P:FULL LOAD Ta:25°C	V1: 185mVp-p

high frequency :



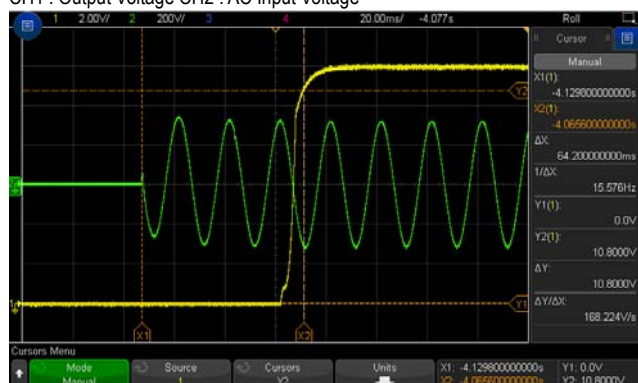
low frequency :



7	SET UP TIME(Max)	230VAC/ 1800ms 115VAC/3600ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 64.2 ms 115VAC/ 153 ms
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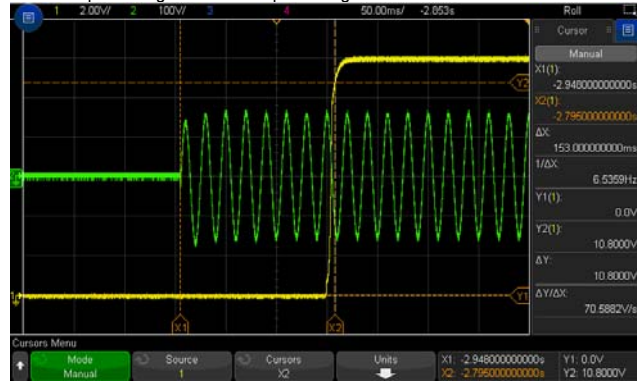
INPUT=230VAC/50HZ @ FULL LOAD

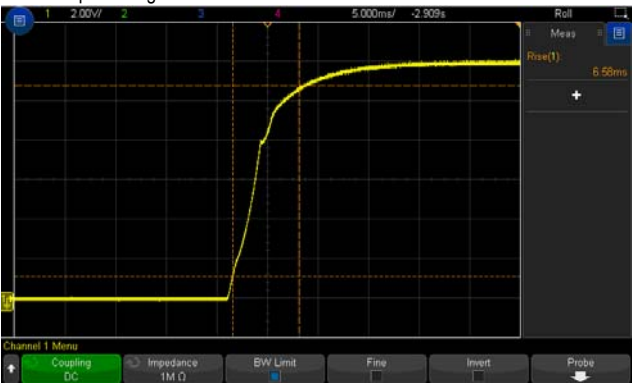
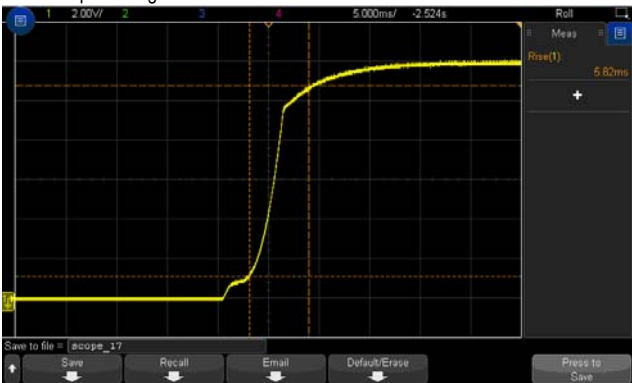
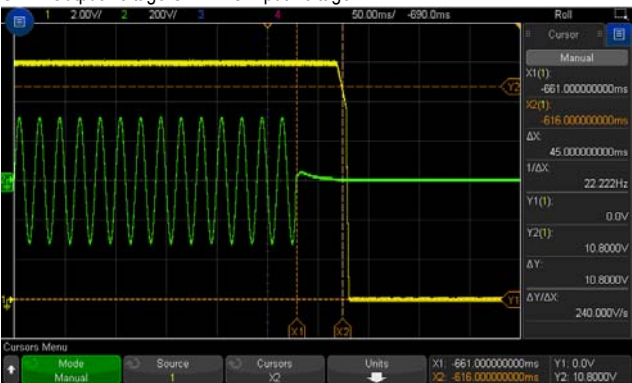
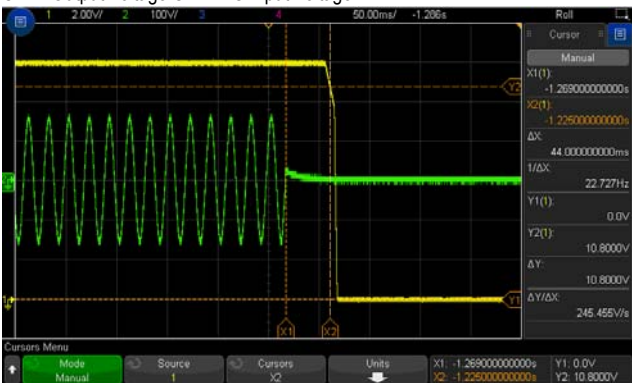
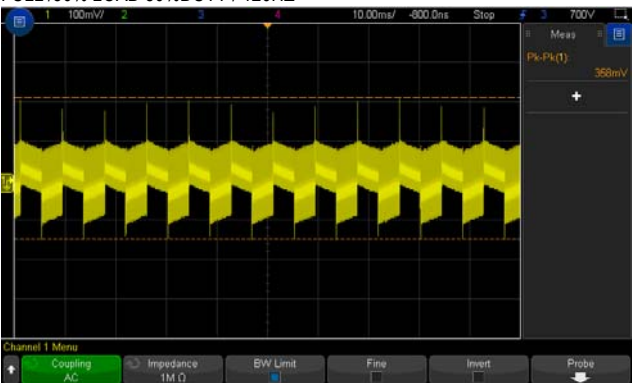
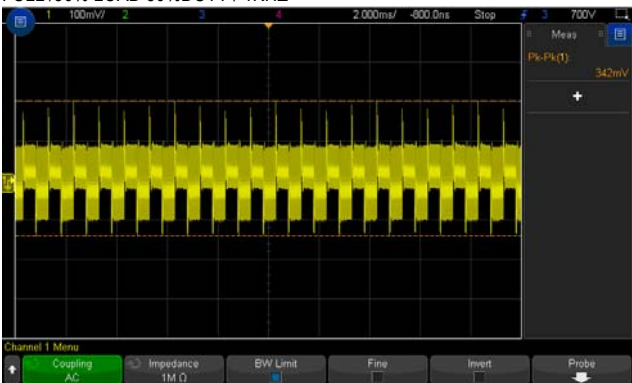
CH1 : Output Voltage CH2 : AC Input Voltage

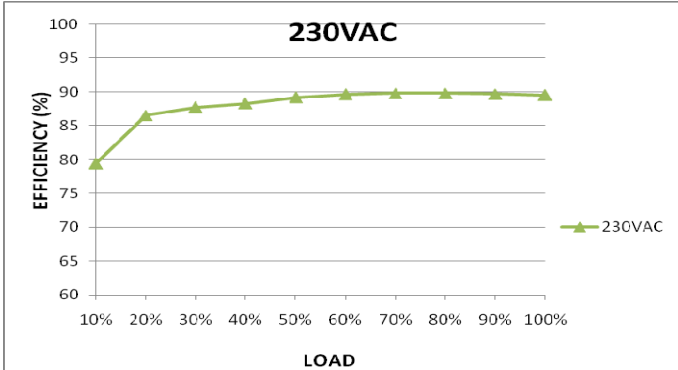
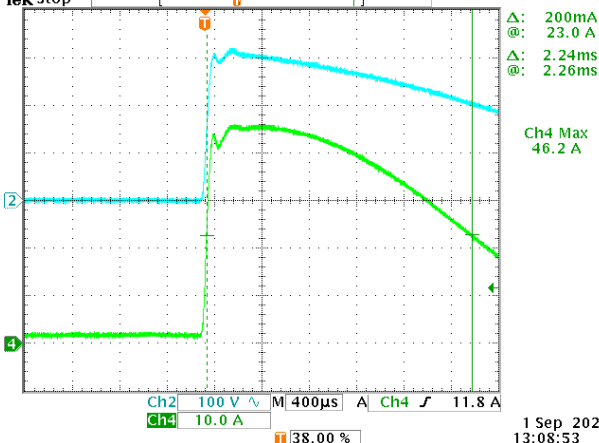
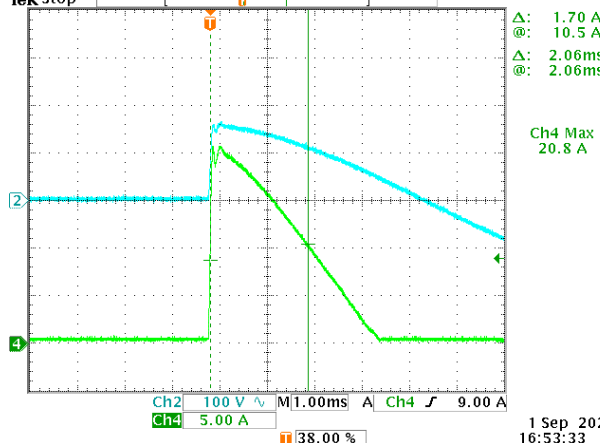


INPUT=115VAC/60HZ @ FULL LOAD

CH1 : Output Voltage CH2 : AC Input Voltage



8	RISE TIME (Max)	230VAC/50ms 115VAC/50ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 6.58 ms 115VAC/ 5.82 ms
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage				
INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage				
9	HOLD UP TIME (Typ.)	230VAC/16ms 115VAC/16ms	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	230VAC/ 45 ms 115VAC/ 44 ms
INPUT=230VAC/50HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage				
INPUT=115VAC/60HZ @ FULL LOAD CH1 : Output Voltage CH2 : AC Input Voltage				
10	DYNAMIC LOAD	V1: 1200 mVp-p	I/P: 230VAC O/P: (1)FULL /50% LOAD 50%DUTY / 120HZ (2)FULL /50% LOAD 50%DUTY / 1KHZ Ta:25°C	358mVp-p 342mVp-p
FULL /50% LOAD 50%DUTY / 120HZ				
FULL /50% LOAD 50%DUTY / 1KHZ				
11	PEAK POWER	NO DAMAGE	I/P : 230 VAC O/P:TESTING Ta:25°C	TEST:OK

6	EFFICIENCY(Typ.)	88%	I/P:230 VAC O/P:FULL LOAD Ta:25°C	89.36%
EFFICIENCY vs LOAD  230VAC Efficiency (%) vs Load				
7	INRUSH CURRENT(Typ.)	230V/70A 115V/35A COLD START	I/P : 230 VAC I/P : 115 VAC O/P : FULL LOAD Ta : 25°C	I=46.2A/ 230VAC I=20.8A/ 115VAC
INPUT=230VAC/50HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current Tek Stop  Ch2 Max 100 V Ch4 Max 46.2 A INPUT=115VAC/ 60HZ @ FULL LOAD CH2 : AC Input Voltage CH4 : Input current Tek Stop  Ch2 Max 100 V Ch4 Max 20.8 A				

PROTECTION FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	OVER LOAD PROTECTION	105 %~ 200 % /5S 280% LOAD > 5s	I/P: 264VAC I/P: 230VAC I/P: 100VAC O/P:TESTING Ta:25°C	111.51%/ 264VAC 111.32%/ 230VAC 111.69%/100VAC 5S TEST: OK PROTECTION TYPE : Normally works within 105%~200% rated power for more than 5seconds and than shut down o/p voltage, re-power on to recover ; Constant current limiting for output power >280% rated for more than 5seconds and than shut down o/p voltage, re-power on to recover

2	OVER VOLTAGE PROTECTION	14.4V~16.8V	I/P: 264VAC I/P: 230VAC I/P: 85VAC O/P: MIN LOAD Ta:25°C	15.9V/ 264VAC 15.9V/ 230VAC 15.9V/ 85VAC PROTECTION TYPE : Shut down o/p voltage , re-power on to recover .
3	OVER TEMPERATURE PROTECTION	Protection type : Shut down o/p voltage , recovers automatically after temperature goes down	I/P: 264VAC I/P: 85VAC O/P: FULL LOAD	O.T.P. Active Protection type : Shut down o/p voltage , recovers automatically after temperature goes down .
4	SHORT PROTECTION	SHORT EVERY OUTPUT 1 HOUR NO DAMAGE	I/P: 264VAC I/P: 85VAC O/P: FULL LOAD Ta:25°C	NO DAMAGE PROTECTION TYPE : Constant current limiting, and shut down after 5 seconds , re-power on to recover .

CONTROL FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT						
1	REMOTE SENSE	S+ / S- >0.3V Compensate voltage drop on the load wiring up to 0.5V.	I/P: 230 VAC O/P:FULL LOAD Ta:25°C	0.372V						
2	DC OK SIGNAL	High (3.3 ~ 5.6V) :PSU turn on Low (0 ~ 1V) : PSU turn off. I/P: 230 VAC O/P:FULL LOAD Ta:25°C Test Result : <table><tr><th>Vout</th><th>DC OK SIGNAL</th></tr><tr><td>PSU turn on</td><td>5.15V</td></tr><tr><td>PSU turn off</td><td>0V</td></tr></table>			Vout	DC OK SIGNAL	PSU turn on	5.15V	PSU turn off	0V
Vout	DC OK SIGNAL									
PSU turn on	5.15V									
PSU turn off	0V									
3	FAN ON/OFF CONTROL	Load 35±15% or RTH2≥50°C FAN ON	I/P: 230 VAC O/P:TESTING	<table><tr><td></td><td>RTH(°C)</td><td>LOAD(%)</td></tr><tr><td>FAN ON</td><td>OK</td><td>27.94%</td></tr></table>		RTH(°C)	LOAD(%)	FAN ON	OK	27.94%
	RTH(°C)	LOAD(%)								
FAN ON	OK	27.94%								

COMPONENT STRESS TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	PWM Transistor (D to S) or (C to E) Peak Voltage	Q 3/Q4 Rated : 32 A/ 650 V VGS : ± 25 V	AC ON/OFF I/P: High-Line = 300V VDS: O/P: (1) Full Load (2) Output Short (3) Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4) Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5) Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6) Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7) 0% → 400% Load. Ta:25°C	Q3 Q4 VDS: VDS: (1) 547V (1) 579V (2) 615V (2) 580V (3) 555V (3) 567V (4) 559V (4) 571V (5) 551V (5) 571V (6) 551V (6) 571V (7) 579V (7) 603V

2	P.F.C Transistor (D to S) or (C to E) Peak Voltage	Q1 Rated : 34 A/ 600 V VGS $\pm$ 25 V	I/P: High-Line =300V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. Ta:25°C	VDS: (1) 465V (2) 436V (3) 469V (4) 461V (5) 461V (6) 441V (7) 449V
3	P.F.C DIODE	D1 Rated : 6A/ 650 V	I/P: High-Line =300V AC ON/OFF O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (4)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz Ta:25°C	(8) 392V (9) 396V (10) 396V (11) 388V
4	Diode Peak Voltage	Q101 Rated : 85A/100V VGS $\pm$ 20V Q104 Rated : 85A/100V VGS $\pm$ 20V	AC ON/OFF I/P: High-Line =300V VOmax O/P: (1)Full Load (2)Output Short (3)Dynamic Load Full Load/ Min. Load 90%Duty/1KHz (4)Dynamic Load Full Load/ Min. Load 90%Duty/3KHz (5)Dynamic Load Full Load/ Min. Load 90%Duty/5KHz (6)Dynamic Load 100% Load/ Min. Load 50%Duty/120Hz (7)0%→400% Load. (8).NO LOAD VO: O/P: (1)Full Load Ta:25°C	Q101: VOmax VDS: (1) 73.8V (2) 69.8V (3) 73.8V (4) 74.6V (5) 74.4V (6) 73.6V (7) 70.3V (8) 72.0V VO: (1) 73.4V Q104: VOmax VDS: (1) 64.4V (2) 66.8V (3) 64.4V (4) 65.2V (5) 63.6V (6) 64.4V (7) 63.6V (8) 61.2V VO: (1) 61.2V
5	Input Capacitor Voltage	C5 Rated: : 680 μ / 400 V	I/P High-Line =300V O/P: (1)Full Load input on/off (2) Min load input on /Off (3)Full Load /Min load Change (4)Full load continue Ta:25°C	(1) 398V (2) 397V (3) 398V (4) 396V
6	Control IC Voltage Test	PWM IC U1 Rated 11V~ 30 V O/P IC U202/ U203 Rated -0.3 V~ 30 V	AC ON/OFF I/P: High-Line =300V O/P(1)FULL LOAD (2) Output Short (3)O.L.P (4)O.V.P. (5)NO LOAD VRmin(LOW LINE) Ta:25°C	U1 (1) 16.5V (2) 16.7V (3) 16.5V (4) 16.7V (5) 14.4V U101 (1) 12.4V (2) 13.0V (3) 12.4V (4) 12.2V (5) 11.6V U202/ U203 (1) 12.6V

			(2) 13.0V (3) 12.6V (4) 12.0V (5) 11.8V
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SAFETY& E.M.C. TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	I/P-O/P: 3KVAC/min I/P-FG :2KVAC/min O/P-FG:0.5KVAC/min	I/P-O/P: 3.6 KVAC/min I/P-FG: 2.4 KVAC/min O/P-FG:0.6 KVAC/min Ta:25℃	I/P-O/P:8.07mA I/P-FG:9.08mA O/P-FG:4.49mA NO DAMAGE
2	ISOLATION RESISTANCE	I/P-O/P:500VDC>100MΩ I/P-FG: 500VDC>100MΩ O/P-FG:500VDC>100MΩ	I/P-O/P: 500 VDC I/P-FG: 500 VDC O/P-FG: 500 VDC Ta:25℃	I/P-O/P: 9999MΩ I/P-FG: 9999MΩ O/P-FG: 9999MΩ NO DAMAGE
3	GROUNDING CONTINUITY	FG(PE) TO CHASSIS OR TRACE < 100 mΩ	40A / 2min Ta:25℃	5 mΩ

E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	HARMONIC	EN61000-3-2 CLASS A	I/P:230VAC/50HZ O/P:FULL LOAD Ta:25℃	PASS
2	CONDUCTION	EN55032 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL/50% LOAD Ta : 25℃	PASS Test by certified Lab
3	RADIATION	EN55032 CLASS B	I/P : 230 VAC (50HZ) O/P : FULL LOAD Ta : 25℃	PASS Test by certified Lab
4	E.S.D	EN61000-4-2 AIR: 8KV / Contact: 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
5	E.F.T	EN61000-4-4 INPUT : 2KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
6	SURGE	IEC61000-4-5 L-N : 2KV L,N-PE : 4KV	I/P : 230 VAC/50HZ O/P : FULL LOAD Ta : 25℃	CRITERIA A
7	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report			

RELIABILITY TEST

ENVIRONMENT TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	TEMPERATURE RISE TEST	MODEL : HRP-600N-12 1. ROOM AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 25.0 ℃ 2. HIGH AMBIENT BURN-IN : 2 HRS I/P : 230VAC O/P : FULL LOAD Ta= 50.0℃		

NO	Position	ROOM AMBIENT Ta= 25.0 °C	HIGH AMBIENT Ta= 50.0 °C
1	ZNR1	25.9°C	52.1°C
2	LF1	26.9°C	53.2°C
3	C61	27.2°C	53.4°C
4	U1	29.7°C	56.1°C
5	T2	30.4°C	57.4°C
6	C5	31.4°C	57.6°C
7	D23	42.3°C	70.1°C
8	L3	39.8°C	66.7°C
9	LF2	26.2°C	52.4°C
10	RTH1	26.6°C	52.8°C
11	RY1	33.2°C	59.3°C
12	BD1	44.6°C	70.7°C
13	Q2	44.8°C	71.8°C
14	D1	50.6°C	77.7°C
15	TSW1	36.1°C	62.8°C
16	T1coil	55.1°C	82.6°C
17	T1core	58.0°C	85.0°C
18	TSW2	46.8°C	74.9°C
19	RG1	45.5°C	72.8°C
20	Q100	52.6°C	81.3°C
21	Q102	60.6°C	89.6°C
22	Q104	50.3°C	78.4°C
23	Q105	41.6°C	69.3°C
24	L100	66.0°C	95.2°C
25	C109	49.8°C	77.6°C
26	C105	45.4°C	72.9°C
27	RTH2	34.1°C	61.8°C
28	Q4	45.1°C	74.2°C
29	U202	32.1°C	58.8°C
30	R106	74.5°C	101.0°C
31	Q19	31.3°C	57.1°C
32	J115	67.0°C	95.8°C
33	R100	58.6°C	87.2°C
34	U101	50.3°C	77.3°C
35	C108	37.3°C	64.7°C
36	R107	69.0°C	95.1°C

2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 230 VAC O/P : 111 % LOAD Ta : 25°C	TEST : OK
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 264VAC/100VAC O/P : 100 % LOAD Ta= -45 °C	TEST : OK

4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C /95 %R.H NO DAMAGE	I/P : 272 VAC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK
5	TEMPERATURE COEFFICIENT	$\pm 0.03 \text{ }^{\circ}\text{C}/^{\circ}\text{C}$ (0~50°C)	I/P : 230 VAC O/P : FULL LOAD	$\pm 0.0051 \text{ }^{\circ}\text{C}/^{\circ}\text{C}$ (0~50°C)
6	STORAGE TEMPERATURE TEST	-40~85°C	1. Thermal shock Temperature : -45°C~ +90°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 10 CYCLE 5. Input/Output condition : STATIC	
7	THERMAL SHOCK TEST	-40~50°C	1. Thermal shock Temperature : -45°C~ +55°C 2. Temperature change rate : 25°C / MIN 3. Dwell time low and high temperature : 30 MIN/EACH 4. Total test cycle : 16 CYCLE 5. Input/Output condition : 15cycle:230V/ FULL LOAD AC ON 3sec/AC OFF 1sec TEST 1cycle:230V/ FULL LOAD Burn In Test	
8	VIBRATION TEST	10 ~ 500Hz, 5G 10min./1cycle, 60min. each along X, Y, Z axes	1 Carton & 1 Set (1) Waveform : Sine Wave (2) Frequency : 10~500Hz (3) Sweep Time : 10min/sweep cycle (4) Acceleration : 6G (5) Test Time : 180min in each axis (X.Y.Z) (6) Ta : 25°C	
9	CAPACITOR LIFE CYCLE	SUPPOSE C105 IS THE MOST CRITICAL COMPONENT (1) I/P : 230VAC O/P : FULL LOAD Ta= 25 °C LIFE TIME (2) I/P : 230VAC O/P : FULL LOAD Ta= 50 °C LIFE TIME (3) I/P : 230VAC O/P : 75% LOAD Ta= 50 °C LIFE TIME (4) I/P : 230VAC O/P : 50% LOAD Ta= 50 °C LIFE TIME		(1) 669212HRS (2) 97431.7HRS (3) 183292.5HRS (4) 314367.7HRS
10	MTBF	Conducted by Parts Stress Analysis Prediction 452.04K hrs min. Telcordia TR/SR-332 (Bellcore) ; 191.26K hrs min. MIL-HDBK-217F (25°C)		
11	Ongoing Reliability Test	I/P : 230VAC O/P : FULL LOAD TA=50°C Demonstration Mean Time Between Failure :50,000 hours		

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	LIUTT		WANGDZ

2018.4.30 GP-A50-F010